ness on the inner walls, so far as these differences are due to the convexity of the inner walls, may become less and less until they fall below the liminal value as a stimulus."—C. R. B.

Symbiosis in orchids.—A recent paper by BERNARD[28] recalls his previous studies on the germination of certain orchid seeds and on the relation of fungi to the tuberization of orchids and potatoes. The present paper advances our knowledge of these fungi and places considerable emphasis upon their place in the development of the orchid group. Three species (*Rhizoctonia repens*, *R. lanuginosa*, and *R. mucoroides*) have been recognized, described, isolated, and grown in pure cultures for considerable periods. Although no spore-bearing structures have been observed, they probably belong to the lower basidiomycetes. The first-named species seems to be the most primitive and most widespread in its symbiosis.

Two series of orchids were studied, those of epiphytic and those of terrestrial habit. The growth of the seedlings was accomplished experimentally in test tubes upon suitable media, and the effect of the fungi and of various concentrations of the media upon their development carefully studied. The results are most interesting and suggestive, and may be summarized as follows: (1) Orchids exhibit a progressive development of symbiosis corresponding to and probably in some measure the cause of their development in phylogenetic series. (2) The evolution in epiphytic and terrestrial families is parallel, and symbiosis is the only common factor which can account for this parallelism. (3) The evolution in symbiosis manifests itself in an advance from independent germination of seeds with normally developed seedlings, to a germination entirely dependent upon the infection of the embryo by fungi and the development of seedlings characterized by protocorms. In the adult plants various progressive stages of symbiosis are exhibited, from an intermittent infection with sympodial habit to permanent symbiosis associated with the monopodial habit of the host. (4) The fungi vary in virulence according to their species, their host, and the length of time they have lived outside those hosts. Very virulent cultures act upon more highly developed orchids in a similar manner to more attenuated cultures upon more primitive species. (5) Concentrated solutions of the culture media have an effect upon germination similar to that produced by infection by fungi, and both symbiosis and growth in concentrated media result in increasing the concentration of the cell contents, which seems to be the necessary condition for the development of these specialized plants.—GEO. D. FULLER.

Recent contributions from the Gray Herbarium.[29]—A. EASTWOOD (Proc. Am. Acad. **44**:563–591. 1909) has published a "Synopsis of the Mexican and

[28] BERNARD, NOËL, L'évolution dans la symbiose. Les orchidées et leurs champignous commensaux. Ann. Sci. Nat. Bot. IX. **9**:1–196. 1909.

[29] Contributions from the Gray Herbarium of Harvard University, New Series, No. XXXVI (Proc. Am. Acad. **44**:563–637. 1909); and No. XXXVII (Proc. Bost. Soc. Nat. Hist. **34**:163–312. *pls. 23–30.* 1909).

Central American species of Castilleja" in which 54 species are recognized, 17 being new to science. A clear and concise key precedes the enumeration and description of species; the same author (*ibid.* 603–608) describes 12 new species of Mexican flowering plants belonging to different genera.—B. L. ROBINSON (*ibid.* 592–596) in a "Revision of the genus Rumfordia" records six known species, of which two are here described for the first time, and (*ibid.* 613–626) under the title "Diagnoses and transfers of tropical American phanerogams" publishes 20 new species and three new varieties, and makes several new combinations.—H. H. BARTLETT (*ibid.* 597–602) gives a "Synopsis of the American species of Litsea," recognizing 11 species, 5 of which are new, and (*ibid.* 609–612) under "Notes on Mexican and Central American alders" describes one new species and three new varieties; the same author (*ibid.*, 627–637) has published 14 new species and varieties of flowering plants chiefly from Mexico, and proposes one new genus (*Basistelma*) of the Asclepiadaceae.

J. R. JOHNSTON has recently issued, as Contribution no. 37 of the above series, a "Flora of the islands of Margarita and Coche, Venezuela," based chiefly on his own observations and collections made on the islands during two expeditions, one in 1901, the other in 1903. A brief historical sketch of the botany of the islands, an account of the physical features, a catalogue of the species, a list of the economic and medicinal plants, the distribution of species, the composition and relationship of the flora are the main topics presented, to which is added a bibliography of all works that relate directly to the vegetation of the islands. Approximately 650 species are known from Margarita and Coche at the present time; and the author estimates that this number represents about three-fourths of the entire flora. Forty-two species and two new genera have been discovered on Margarita during the course of Mr. JOHNSTON'S preparation of the present publication. The relationship of the flora, as would be expected, is with the mainland. The work forms an excellent basis for future investigations on the flora of the islands; it is, moreover, of particular scientific value since the plants on which the catalogue of species is based are deposited in several of the larger herbaria of Europe and America.—J. M. GREENMAN.

Anatomy of Zamia.—MATTE[30] has recently published an addition to the number of investigations in the interesting field of cycad anatomy. Zamia is the subject of the present work, the species studied being *Zamia floridana* and *Z. integrifolia*. The paper shows the anatomy of Zamia to be of the ordinary cycad type.

In the embryo, the vascular plate of the cotyledonary node is a protostele. Each cotyledon receives three strands, which undergo the usual branching and anastomosing, and exhibit transfusion tissue at the tips. At the base of the cotyledons the strands are mesarch and may be even concentric; they are exarch in the middle and upper regions. The first leaves are opposite, but later ones

[30] MATTE, H., Sur la structure de l'embryon et des germinations du genre Zamia L. Bull. Soc. Sci. et Med. de l'Ouest **18**:nos. 2 and 3. 1909.